087041

JPRS-WST-86-004

23 January 1986

West Europe Report

SCIENCE AND TECHNOLOGY

FBIS FOREIGN BROADCAST INFORMATION SERVICE

0
51
AΦ4

JPRS-WST-86-004

23 January 1986

WEST EUROPE REPORT
SCIENCE AND TECHNOLOGY

CONTENTS

MICROELECTRONICS

SCIENTIFIC AND INDUSTRIAL POLICY

AEROSPACE

ESA'S 20-YEAR EXPLORATION PROGRAM

Utrecht ZENIT in Dutch Jul-Aug 85 pp 247-249

[Article by Govert Schilling: "Exciting Future for European Space Research"]

[Text] On 30-31 January 1985 an ESA [European Space Agency] conference at ministerial level was held in Rome during which a long-term program for European space exploration was mapped out (see ZENIT May 85 p 178). The spectacular decisions of this conference were amply discussed in the press: ESA is going to participate in the American plans for a manned space station orbiting the earth. Furthermore, a new and powerful version of the Ariane rocket will be developed which may even be able to launch a European manned space shuttle in the future.

So far, so good, but what about the plans for scientific space exploration? Here, too, an agreement has been reached which will enable Europe to play a major role in international space research by the end of this century. After all, ESA has put scientific research on top of its priorities list since its foundation, and important results have already been produced in this field in Europe. SPACE SCIENCE HORIZON 2000 has proposed an outline of European space exploration for the next 20 years. This is an ambitious and quite promising program which has been adopted in principle by the ESA member states in its entirety.

Long Term Planning

Not all scientific research conducted by ESA comes under the control of one department. The science department only covers research in the fields of astronomy, solar physics, heliosphere research, plasma astrophysics and planetary research. Hence, new technological applications of space exploration, e.g., in the fields of microgravity research, life sciences and materials sciences, are not covered by the program that was drafted by the research committee.

This is the first time that ESA has mapped out such a comprehensive long-term program for scientific research. Up to now space research projects have always been selected and carried out on a more or less ad hoc basis. Every couple of years a number of projects which might be considered for further research were selected out of a number of submitted suggestions.

Eventually, a couple of these projects would be singled out and actually executed by ESA. Examples of projects selected this way are the Hipparcos satellite for astrometric research and the Ulysses space probe (formerly ISPM, International Solar Polar Mission), which will investigate the heliosphere outside the ecliptic plane. Apart from these European programs there were also the national programs, of which IRAS [Infrared Astronomical Satellite] is a typical example.

However, as specialization in space research increased, it became more and more apparent that a long-term program was needed. Some ambitious programs require a much lengthier preparatory program, while others must take into account operations carried out in the same field by, for example, NASA. On the initiative of Roger-Maurice Bonnet, managing director of ESA's scientific program, a special committee carried out an investigation which lasted from October 1983 until July 1984 and was chaired by Johan Bleeker from the Dutch Space Research Foundation (SRON). At the end of 1983, European scientists were invited to submit proposals which might be incorporated into the 20-year plan. The 77 suggestions submitted were examined for feasibility and priority by a number of teams of experts in the respective scientific fields. In the summer of 1984, a general meeting of the investigatory committee together with these topical teams formulated the basis for European space research for the next 20 years.

Four Cornerstones

The 20-year plan rests on four cornerstones of scientific research. Each of these cornerstones will cost an estimated one billion guilders, an amount that has never before been spent by ESA on one specific scientific project.

The first cornerstone does not consist of one project, but two, each costing approximately 500 million guilders. The first project is an observatory in the L1-Lagrangian point of the sun-earth system. Somewhere on the connecting line between the earth and the sun (but far closer to the earth than to the sun) is a sort of equilibrium point where a space probe can be maintained without expending much energy. From this position, the heliosphere (the sun's atmosphere) can be studied thoroughly, and solar wind and the corona's structure may also be continuously observed. Presently, ESA is engaged in a preparatory study for such an observatory; the Solar Heliospheric Observatory.

The second project within the Solar Terrestrial Program (STP) involves a cluster of satellites for plasmaphysical research in the earth's magnetosphere. The ISEE program (International Sun-Earth Explorers) and the AMPTE [Active Magnetospheric Particle Tracer Experiment] mission have provided the necessary experience for working with these satellite clusters. The Cluster Project will consist of four relatively closely placed satellites to investigate the small-scale structure of the earth's magnetosphere.

Both the Solar Heliospheric Observatory and the Cluster Project may play an important role in the ISTP (International Solar Terrestrial Program), in which, in addition to Europe, the United States, Japan and possible the Soviet Union will also cooperate.

The second cornerstone of the 20-year plan is, according to European standards, a daring enterprise: a mission to a planetoid or comet to collect samples and bring them back to earth. With the prospective success of the Giotto Probe to Halley's Comet, Europe has the opportunity to play a leading role in the field of "primitive" matter in the solar system. Research into meteorites has already lifted a corner of the veil which still surrounds the origin of our solar system. It would be particularly important, however, to compare these results very accurately with the composition of planetoids. A "soil sample" from a comet would possibly be even more interesting: it would be the first time that we would be able to study stardust microscopically in a laboratory. The composition of comets is presumably a good reflection of the interstellar material from which new stars are formed. The need to develop an ion engine constitutes a major technological challenge for this project. A conventional rocket engine would have to carry far too much fuel to be able to carry out such a flight.

Spectroscopy

The third cornerstone in the ESA program is a very sensitive X-ray spectroscope for astronomical research. This project is a good illustration of the considerations that have played a role in the ultimate selection of projects. High energy astrophysics is a very important research area in astronomy, and thanks to COS-B [a satellite class] and Exosat [European X-ray Observatory Satellite], Europe has already considerably extended our knowledge in this particular field. However, it was decided not to conduct further research into gamma ray astronomy because the American Gamma Ray Observatory (GRO) is to be launched within a couple of years. This observatory will thoroughly observe the entire firmament by means of gamma radiation, just as IRAS did with infrared radiation. NASA also has a promising project coming up as far as X-rays are concerned: the Advanced X-ray Astronomical Facility (AXAF). AXAF is an extremely sensitive high resolution X-ray telescope. AXAF is designed to pursue the preparatory work of the Einstein Observatory (HEAO-2 [High-Energy Astronomical Observatory]) and of Exosat. Europe can nevertheless make an important contribution in the field of X-ray astronomy as far as spectroscopy is concerned because this is not a central facet of the AXAF program. Hence the plans for a European X-ray spectroscope. The American AXAF will be capable of locating and mapping X-ray sources from a great distance, whereas the European spectroscope will provide insights into the physical processes which generate X-rays.

Here, too, ESA is faced with a major technological challenge because large numbers of grazing incidence mirrors must be developed and manufactured for this spectroscope. Europe, however, has only limited experience in mass-producing these. In fact, a kind of multiple mirror telescope will be

developed, but for X-rays. The spectroscope will be able to make observations in the energy range of 0.1 to 20 kiloelectrovolts. It will not only be capable of studying small X-ray sources, such as remnants of a supernova, but also very large sources. Thus, it will be possible, for instance, to examine the composition of interstellar clustered gas by means of X-ray spectroscopy.

The fourth cornerstone, finally, is a program in the field of submillimeter wave lengths. In fact, wave lengths of this kind constitute the last area of the electromagnetic spectrum which has not yet been entirely explored. It is virtually impossible to make observations from earth because of the absorbing action of the atmosphere. Within a couple of years the American COBE (Cosmic Background Explorer) will be launched, which will primarily concentrate on the distribution of cosmic background radiation in the submillimeter range. In the very long run, there are American plans for a millimeter telescope in space, the Large Deployable Reflectory (LDR), which is to have a diameter of 20 meters. For the time being, however, this project cannot be executed because it requires special techniques that are not yet mastered. Europe hopes to accomplish much with a submillimeter spectroscope in this wavelength range. These wavelengths are expected to contain emission and absorption lines of important atomic and molecular transitions, while interstellar dust emits continuous radiation in the submillimeter range. Such a project can provide a lot of information on the chemical composition of the very coldest parts of the universe, with temperatures ranging from 3 to 1,000 Kelvin (-270 to approximately 700 C).

The Distant Future

The investigatory committee has also contemplated the distant future, i.e., projects scheduled for after the year 2004. In the field of solar physics it is considering the Heliosynchronous Out of Ecliptic Mission (HOEM) and the Solar Probe. The HOEM consists of a probe which revolves about the sun in a heliostationary orbit, thus hovering roughly over the same point on the sun´s surface. We said "roughly" because the sun does not rotate like a solid body and because the probe will have a steeply inclined orbit. The aim of the project is to obtained detailed information about structures on the sun´s surface and their evolution, and to obtain a spatial image of phenomena on the sun´s surface. Its distance from the sun would amount to some 30 solar rays. The Solar Probe will even go a few steps further: on its elliptic orbit it will approach the sun to within a few solar rays so that measurements can be taken in situ in the corona at attitudes where the acceleration of solar wind particles takes place. It will also be possible to examine in detail the sun´s gravitational field, which will accurately test the general theory of relativity.

Planetary researchers can already look forward to the launching of an unmanned Mars vehicle. The Mars Rover is indeed regarded by ESA as the most promising project in this field for the next century. This vehicle (a very advanced robot) is capable of covering great distances and of taking soil samples of interesting structures.

As far as astrophysics in the next century is concerned, ESA sees special opportunities for interferometry in the fields of optical, infrared and millimeter astronomy. In these classes of wavelengths it may be possible to equal or even to exceed the resolution powers of radio-interferometers.

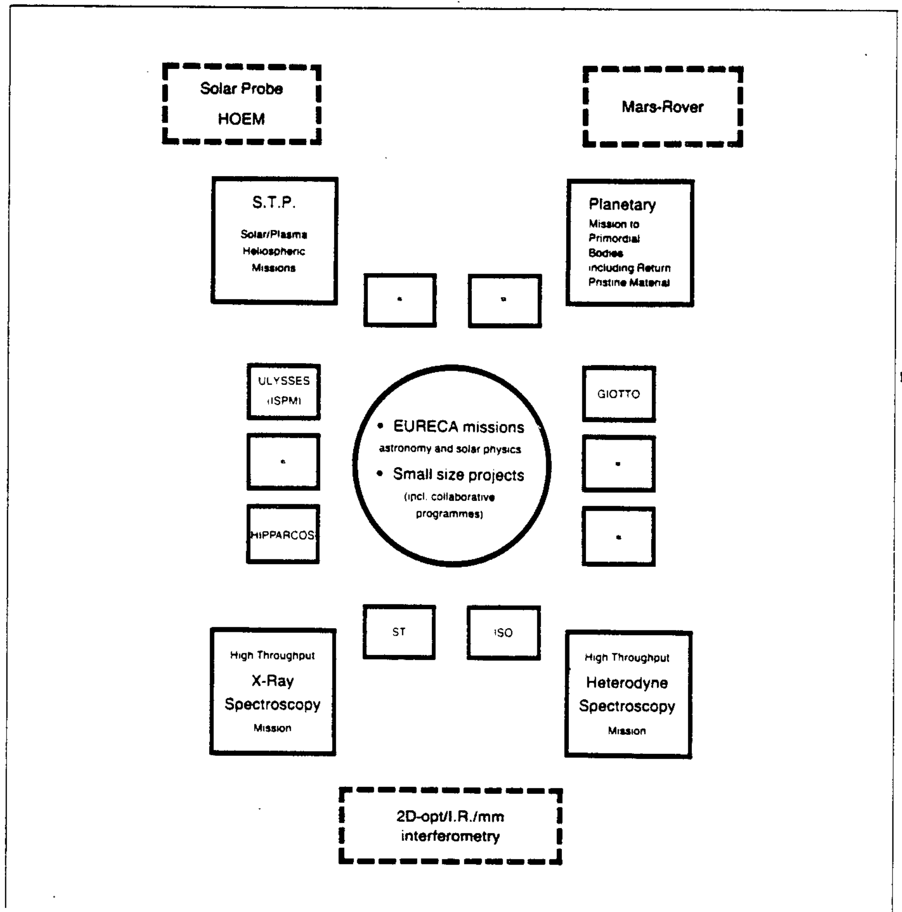
However, these plans for the distant future remain for the time being beyond ESA´s financial capacities. The annual scientific budget may indeed have been increased to approximately 500 million guilders but this is not nearly sufficient to carry out the projects scheduled for after 2004. Even so, ESA will have to take these long-term plans into account when developing new technologies.

Minor Projects

On a smaller scale, the ESA 20-year plan for scientific research also includes a number of less expensive projects on the order of 500 million guilders. These projects include the aforesaid Ulysses Probe and the Hipparcos Satellite, the Giotto Probe, the European contribution to the Hubble Space Telescope and ISO (Infrared Space Observatory), which is scheduled to replace IRAS in the 1990´s. Other projects in this category have not been determined yet. This will be done by means of the currently approved method of submitting proposals, followed by a selection procedure which will finally sort out the most important projects. There are plenty of projects, e.g., the Keppler mission to Mars (a space probe orbiting the red planet); a probe orbiting the moon and possibly even over its poles; and a project for radio-interferometry in space. In the latter project, a radiotelescope orbiting the earth is to be connected to an existing VLBI (Very Long Baseline Interferometry) network. This Quasat Satellite, as the project has already been named, will improve resolution enormously. It will permit detailed research of radio star systems and particularly of quasars, hence the name of the satellite. For the rest, there are plans for research projects in the fields of solar physics, polar light, ultraviolet spectroscopy, stellar vibrations, etc. Time will show which of these projects will be carried out.

The last part of ESA´s long-term scientific program involves inexpensive projects, each costing approximately 250 million guilders. They primarily include payloads for free orbiting space platforms, such as the Eureka platform, and European participation in American projects, for instance, such as a combined Saturn-Titan mission (the Cassini Project). International coordination will be necessary for the platform instrumentation too. Europe will probably never be able to use the entire capacity of the platform; thus a flight would only be profitable when other space agencies supply payloads. The Eureka platform will be of particular importance in the fields of X-ray and gamma ray astronomy as well as in solar research.

With these long-term plans for European space research as established by the SPACE SCIENCE HORIZON 2000 report ESA will make a major contribution to important developments in astronomy. The success of this 20-year plan will determine to a large extent what will be possible after 2004.



Schematic representation of ESA's 20-year plan for space exploration

25017 / 12781
CSO: 3698/1056A

BIOTECHNOLOGY

RESEARCH AT MAIN FRG BIOTECHNOLOGY CENTER IN BRAUNSCHWEIG

Duesseldorf VDI NACHRICHTEN in German 6 Sep 85 p 4

[Article by B. Junghanss: "Biotechnology: A Science Revolutionizes Life. The Scientific and Technical Infrastructure in Brunswick Is Based Upon Interdisciplinary Cooperation"]

[Text] "Today biotechnology is generally given the rank of a key technology pointing the way for the future. On the other hand biotechnological processes are as old as human cultural history--isn't this a contradiction?"--with these words Prof Dr Joachim Klein, scientific director of the Association for Biotechnological Research, Inc. (GBF) in Brunswick, outlined the area of effort for this modern discipline. The GBF is the Center for Biotechnological Research in the Federal Republic. As a member of the Study Group of the Major Research Establishments (AGF), the GBF has the responsibility for carrying out research and development efforts in the field of biotechnology.

"Behind the term biotechnology," continued Klein, "is a number of theses and areas of uncertainty that must be coordinated with various disciplines in nature and technology. It should be considered that the way of thinking of the natural scientists--development of basic science without the obligation for practical applications--and the engineers--realization of technical processes for the needs of the present--not necessarily leading to each other; thus the area of intensification becomes clear in which biotechnology must find its way into the future." That even the Federal Republic attributes great significance to biotechnology is shown by the fact that, as recently announced, it should be expedited up to the year 1989 with DM 1 billion. With this, according to Federal Research Minister Riesenhuber, the jump of biology into a formal science should be supported, which could change the future.

In 1976 the GBF split off from the Volkswagen Works Foundation founded Association for Molecular Biological Research (GMBF) and since then financed in a ratio of 90:10 by the association represented by the Federal Ministry for Research and Technology (BMFT) and the Land of Lower Saxony. The research and development efforts of the GBF lie to a great extent within the scope of the biotechnology program of the Federal Government. The GBF pursues exclusively peaceful aims and should contribute to the solution of public problems: a sufficient supply of chemicals, pharmaceuticals, and raw materials for foods, assuring the natural resources and a healthy environment.

With the carrying out of research plans the cooperation of research teams from industry and the universities is sought; the service unit "Biotechnikum" carries out under contract the production of natural products not obtainable commercially. In this case value is placed upon the coordination with the contracting research groups in order to exchange information and to promote the transfer of data to industry.

The scientific and technical infrastructure of the GBF is based upon interdisciplinary cooperation and is composed of the following special disciplines: biotechnology, genetics, high molecular natural products, microbiology, molecular biology, low molecular natural products, physical measurement techniques, plant cell structures, metabolism regulation, cellular materials transport, in addition there are the central computer system, the library, and various technical departments. In 1979 the German Collection of Microorganisms (DSM) was established in Goettingen. There around 5,000 different species of microrganisms are preserved and made available for research and development programs.

The advantage of this infrastructure is that even complex biotechnological projects--from the microbiological or cell biological efforts to the process technology development in the Biotechnikum of the GBF--can be carried out effectively in one place. In this case the application oriented fundamental research is carried to the point where industry can build upon it with the development of new biotechnological processes.

The study program at this time concentrates on the following research interests: biosynthetic products from microorganisms, animal cell products important to medicine, natural products from plant cells, enzymatic conversions and enzyme technology, biosynthesis technology.

Some of the individual projects in this program, that have been brought to a successful conclusion during the past few years, will be presented briefly below.

The production of human β-interferon: interferons (so far four different structures are known) are proteins of small size and number (only one in 30,000 protein molecules is an interferon molecule) that protect the cells from virus attacks. The gene responsible for the β-interferon production in humans is about one in a million genes. The GBF for the first time was successful in cloning this interferon gene and in analyzing the structure (DNA sequence). Since interferon can be obtained from human cells only in small quantities, the isolated interferon gene was incorporated (transferred) in bacteria (Escherichia coli) and animal cells and adapted. The fibroblasts (cells in the connective tissue) of the mouse proved to be ideal for this purpose. These genetically manipulated mouse cells, whose genetic make-up is now, so to speak, "crossed" with the human interferon gene, can be cultured on a mass production scale and produce under these culture conditions great quantities of interferon. The culturing of these mouse fibroblasts is carried out so far in a bioreactor with a capacity of 25 L; in this the cells together with the culture medium and microcarriers (small elastic balls) are incubated. The cells cling to the microcarriers and multiply on them until

they are completely covered. In this case they permanently give off human β-interferon, and this process can be kept going continuously with the regular renewal of the culture medium. From the siphoned off supernatant the interferon is worked up with a specially developed aqueous two-phase system, purified, and the interferon-containing phase is further refined by means of high pressure liquid chromatography.

Further successes in the area of gene technology, this central and fundamental field of biotechnology, which encompasses the directed reconstruction of hereditary factors (that is the DNA) of microorganisms or isolated plant and animal cells; through gene cloning a strain of the bacterial species Escherichia coli has been created that provides a sevenfold more effective production of the enzyme penicillinacylase. This enzyme is needed in order to split natural penicillin into two parts, from which chemically modified, clinically more effective, so-called semi-synthetic penicillins can be produced. With the newly developed process of enzymatic cleavage the chemical method used so far, which is associated with a more severe environmental pollution, can be economically replaced.

Methods were developed further that increase enormously the number of possible new combinations of genetic material (the so-called "cementing substances" for the DNA fragments). "Genetic fishing lines" to locate definite genes were synthesized along with substances for the directed, punctiform mutation of natural DNA. A process for the simultaneous synthesis of a large number of short DNA fragments and the ultrarapid analysis of synthesized DNA components make possible the chemical rapid synthesis of whole genes. These processes with their enormous advantages in cost and time place the GBF at this time in a position of world leadership in this area.

In the area of process development regarding the recycling of raw materials in cooperation with the Emsland Starch Company a pilot plant for the processing of the starch-containing effluents from the plant into butanol and acetone was put on line. Through the fermentation of wastes in the future a significant overloading of the wastes treatment plant can be profitably avoided. The goal of the project is to test the economy of the construction of a large scale installation ("scale up") for the Emsland Starch Co.

Of decisive importance for each biochemical process technology is the continuous analysis of chemical and biochemical substance quantities for the control, regulation, and directing of the production of process development. So far the coupling of the corresponding analytical instruments to the process--for example, the fermenter--was connected with special problems. In cooperation with the B. Braun-Melsungen Co., Inc., a patented process has now been developed that makes possible the aseptic, continuous, and representative sampling at any time and rapidly.

Since the course of biological processes in bioreactors is influenced by many different factors, until then there were difficulties through a lack of uniform process procedures in the transfer of methods or data from one laboratory to another. Comprehensive comparison tests for broad areas of

microbial substances production with the aid of a reference bioreactor from Dechema (German Society for Chemical Apparatus) now makes possible for various manufacturers and users of bioreactors to compare and to transfer their experimental results and processes with and to each other, which on the long term makes possible a more effective operation.

Although since the discovery of penicillin almost 7,000 different natural antibiotics have been isolated and described, there are still areas of application for antibiotics that are not yet or only insufficiently covered: for example, fungal and viral infections, tropical diseases, plant protection, or the control of resistant bacteria. Accordingly, pharmaceuticals with antibiotic properties are still being sought all over the world. For this "screening" particularly sharply refined test methods or microorganisms that were examined little so far are being incorporated. It was found in a GBF screening program that the myxobacteria ("gliding bacteria," morphologically and biochemically highly differentiated species of bacteria) widely spread in the soil and so far almost unnoticed produce antibiotics with great frequency. So far about 60 such new compounds could be isolated and described. Some of them proved to be inhibitors of a central and so far not clarified site in the biochemical process of the "respiratory chain" in bacteria and found use in biochemical research. Additional applications of the isolated substances are being examined at this time.

The scientific areas of the GBF have about 15,000 m^2 useful surface available, of these about 5,000 in the Biotechnikum, in which the sections that are technologically equipped are housed. The installation of apparatus permits large scale cultures of microorganisms in reactors of up to 5,000 liters in capacity as well as separatory and isolation processes for natural products with high and low molecular weight up to the semi-technical level. A portion of the Biotechnikum capacity as the "Biotechnikum Service Unit" is made available to research institutions and to industry for carrying out pilot plant projects. A total of about 390 workers are kept busy, among these about 150 scientists (as of 1984), the annual budget comes to about 31 million (1984).

Organs of the Association are the Association Board (representing here the Union and the Land of Lower Saxony through their secretarial departments, the Federal Ministry for Research and Technology, and the Lower Saxon Ministry for Finance), the supervisory council of representatives from the authorized ministries and external scientists (he differentiates between the general research objectives and important political and financial affairs regarding research). The Scientific-Technical Council and the Scientific Committee advise the organs of the association on scientific and technical questions and important questions on cooperation with industry.

12446/6091
CSO: 3698/10

BIOTECHNOLOGY

BRIEFS

BRAUNSCHWEIG ACHIEVEMENTS IN 1984--The year 1984 introduced many changes for the GBF (Association for Biotechnological Research) in Brunswick even in the scientific area. Accordingly, the research interest in natural products from plant cells was given up in favor of a strengthening and expansion of other research areas and a series of thematically new projects was initiated. In the research area in biosynthetic products from microorganisms the efforts into new antibiotics from gliding bacteria was intensified and in addition the search for new, commercially interesting enzymes was taken up. The efforts in gene technology were intensified with respect to the cloning of β-interferon in Escherichia coli. In the case of efforts into β-interferon from mouse fibroblasts the process technology by cooperation between the Section for Genetics and the Bioprocess Technology was brought to the point that in the meantime the Diessel Company in Hindesheim can market on the basis of gained experience a cell culture fermenter with the membrane mixing system developed by the GBF. The cooperation of the GBF with foreign research groups and industry is shown particularly by the utilization of the technical school's equipment by external partners. While in 1983 only 81 fermentation installations with a total volume of 16,375 L were in operation, in 1984 the number came to 143 installations with a total volume of 35,710 L. Accordingly, the GBF is taking an interest in the commercial production of natural products otherwise not obtainable. [Text] [Duesseldorf VDI NACHRICHTEN in German 6 Sep 85 p 48] 12446/6091

CSO: 3698/10

COMPUTERS

ECRC PRESENTS ARTIFICIAL INTELLIGENCE PROTOTYPES

Munich COMPUTERWOCHE in German 11 Oct 85 pp 1, 6

[Article by bi: "Precompetitive Collaboration by Bull, ICL and Siemens Shows Results: Europeans Present First Artificial Intelligence Prototypes"]

[Text] Munich--The European Computer-Industry Research Centre (ECRC) recently presented, with prototypes, the first results of cooperative French-English-German research in the "artificial intelligence" (AI) area. The joint venture of the European producers Bull, ICL and Siemens, active since January 1984, presently works with a staff of 36 out of the 50 scientists it hopes to employ.

In lectures and through demonstrations on the system, the European technical press was shown a Prolog computer, an object-oriented language, an interface between Prolog and relational databanks, as well as an interactive graphics tool for knowledge-based systems.

The team, which has been working in four groups hiterto, is marketing its products through seminars directed to the marketing people of the respective partner firms, who in turn sell to the various areas of application within their own firms.

The firm, which has been set up in the "precompetitive" realm in the form of a private joint-stock company, has a capital of 1.8 million marks and will, when fully shaken down, operate with an annual expenditure of around 20 million marks, according to estimates by the French director of this European research venture (using English as its working language, on German soil), Herve Gallaire. Before year's end the international research team is to grow to 40 members. Reinhard Veelken, chairman of the stockholder group and ex-Siemens employee, hopes that, with 50 scientists specifically devoted to industrial research, that is, to research that "gets results" within deadlines, "the world's knowledge will be represented in this institute to the benefit of the three corporations." The three European producers, which think of themselves in this relationship primarily as "mainframers," have equal shares in ECRC, and detail their own researchers to Munich; but, as is emphasized, first-class scientists are also acquired from the marketplace.

Development is proceeding under UNIX in its various versions. This operating system was chosen because it permits agreement on the lowest common denominator.

The work program includes:

Logical Programming:

Application of formal logic to programming and knowledge processing as well as development of methods and tools for the creation of software prototypes.

Knowledge-Based Systems:

Building up systems which, by bridging the gap between classical and deductive data banks, are capable of modelling complex relationships and of drawing conclusions.

Symbolic Computer Architectures:

Design of high-performance computers with parallel system architecture, in which the parallel-processing characteristics can be based on the language, on the computational model, and on the technical execution.

Man-Machine Interface:

Use of devices such as, for example, terminals with graphics capability and tools for user support through interaction with decision-support systems.

All the research activities of the ECRC are directed toward computer-supported decision-making.

13070/12790
CSO: 3698/125

COMPUTERS

BRIEFS

CRAY 1S 2000 FOR SWITZERLAND--This October one of two Cyber 855 computers at the ETH Computer Center in Lausanne, will be replaced by a Cray 1 S. This machine is the first high-performance processor or Supercomputer operating in Switzerland. This event is of outstanding significance to the ETH Lausanne, to other Swiss Universities and industry, since it will finally permit the development of scientific and technical applications of digital simulation. Unfortunately, the Swiss still have none of these high performance processors, of which there are already 40 in Western Europe, and 130 world-wide. The first machines were produced in 1976. The backwardness of our nation in the information sector is particularly severe in the case of large digital computations, since it is increasingly reflected in numerous disciplines in engineering and in basic research. [Excerpts] [Bern TECHNISCHE RUNDSCHAU in German 9 Jul 85 p 41] 9280/12790

STATUS OF FRG SUPERCOMPUTER--The prototype of the first German supercomputer for numerical applications (Suprenum) is to be ready by the end of 1988, and is to lend itself to applications in scientific-technical taskings (for example, in meteorology, in astronomy, or in computation of currents), as Dr -Ing. Karl F. Triebold, Managing Director of Krupp Atlas Electronics in Bremen, reported on 12 September. The superfast computer is built up from many identical individual computers, which are arranged in parallel and are connected by a fast network. To push the project forward, the Suprenum Corporation for Numerical Supercomputers is to be founded at the beginning of next year. Krupp Atlas Electronics will have a 54-percent share in it, the Corporation for Mathematics and Data Processing (GMD) of St Augustin near Bonn will have 28-percent, and the Hamburg Stollmann Corporation 18-percent. Furthermore, a number of German university institutes are sharing in the realization of the German supercomputer, which is to attain the performance of American and Japanese computers, and the federal Minister for Research and Technology is making available the largest portion of the funds, estimated at 100 million marks. [Text] [Duesseldorf VDI NACHRICHTEN in German 20 Sep 85 p 1] 13070/12859

CSO: 3698/119

DEFENSE INDUSTRIES

DFVLR OF FRG TAKES OVER 'ATTAS' RESEARCH AIRCRAFT PROJECT

Frankfurt/Main FRANKFURTER ALLGEMEINE ZEITUNG in German 30 Oct 85 p 34

[Article by A. Johansen: "A Many-Sided Research Aircraft: 'Attas' Unique in Europe/Refitted VFW 614 for the DFVLR"]

[Text] The fact that European aircraft production can fully keep pace with American competition today--in the first instance through the Airbus--is not least attributable to the good standing of European aviation research. Even NASA and Boeing have now arranged to have research done at the German-Dutch Windtunnel, where comprehensive measurements are also in progress for the new, smaller Airbus A320. Now the German Research and Experimental Institute for Aeronautics and Astronautics (DFVLR), which is responsible for operation of the German-Dutch Windtunnel from the German side, has taken another important step. It has taken over from Messerschmidt-Bolkow-Blohm (MBB) the new research aircraft Attas (Advanced Technologies Testing Aircraft System), which offers hitherto unimagined possibilities for flight research in Europe. With this machine we are talking about a VFW 614 which has been reconstructed and fitted out for its research missions over a period of four years. Work stations for four research engineers were created in the cabin, which was originally intended for 44 passengers.

The plane's refitting, which is now to be completed by the DFVLR in Braunschweig, also includes the installation of numerous sensors, additional small control surfaces on the wings of the VFW 614, and electrohydraulic drives for the controls. These give the pilot "fly by wire" capability, in which commands to the elevators, the rudder, and the ailerons are given electronically by cables. Small motors then set the control surfaces as the pilot wishes. Traditional aircraft control systems, on the contrary, rely on a largely mechanical connection between the cockpit and the individual control surfaces.

There are even plans for "fly by light" in the future: the transmission of commands would then take place, not electrically through copper wires, but by light pulses through glass-fiber cables. Very much more information can be sent over a light-guide than over a copper wire of the same size. Weight savings are obtained for another thing. (For example, wiring with a total weight of around a ton is installed in an Airbus.) Furthermore, the danger of interference, short circuits and the like is eliminated with fiber-optical wiring.

Starting in mid-1986, Attas will be used to investigate how the effects of squalls and turbulence on aircraft can be mitigated with a newly developed system. In future the system is to raise flight comfort considerably and reduce stress on materials in passenger aircraft. The safety and performance of aircraft is also to be improved with the help of computer-guided control systems. Attas is further intended to simulate the flight characteristics of new aircraft that are still in the design stage. Finally, the experiments will also be concerned with harmonizing flight-control and flight-safety systems through the use of digital computers and interference-free plane-to-ground communications. More exact flight control and smaller distances between planes will thereby become possible, and therewith also a reduction of airborne prelanding delays. Optimum conditions for pilots are being sought as well, through newly configured and newly instrumented cockpits.

At the takeover of Attas in Braunschweig recently, it was claimed that, in this new research aircraft, an experimental platform unmatched by anything in Europe has become available. Attas had reportedly also stirred considerable interest in the United States. This could not be otherwise, as the director of the flight research center of the DFVLR in Braunschweig, Professor Fred Thomas, put it, "for whoever falls even one step behind in modern aviation technology will--as the examples of Lockheed and others show--quickly be driven from the commercial aircraft market."

Peer Hamel of the DFVLR in Braunschweig pointed out the breadth of Attas' spectrum of missions. With the new plane, testing of the flight-control system of the planned European space shuttle Hermes can be taken over, should Germany yet decide to participate in the Hermes program.

13070/12859
CSO: 3698/119

FACTORY AUTOMATION

ITALIAN 'MODIAC' SYSTEM FOR CONTROLLING INDUSTRIAL ROBOTS

Turin NOTIZIARIO TECNICO AMMA in Italian March 1985 pp 12-16

[Article by Giorgio Bruno et al.: "The Modiac Multiprocessor System for Controlling Industrial Robots"]

[Text] Introduction

The development of industrial automation systems, made possible by the recent progress in information processing technology, is proceeding in two main directions. The first is integration into a single system of equipment and functions which had been isolated in the past. This is leading to integrated distributed systems marked by great complexity for which high reliability and diagnostic capacity requirements are set. The second direction is that of increase in local processing power. It involves modular solutions (multicomputer structures) for process control and dedicated units (regarded as intelligent peripherals of the processing center) for basic automation and instrumentation.

Because of this new technological complexity, there has simultaneously been an increase in the costs of programming and plant start-up. There is thus a need for rationalization of applications software by using evolved real-time languages and for employment of suitable programming lines which in the broad sense may include CAD instruments for configuration of control systems.

The MODIAC system developed under the Finalized Information Science Project of the National Research Council fits into the context just outlined. MODIAC is an advanced industrial automation system having the following chief characteristics.

Local network architecture whose centers, which are connected to a high-speed serial line, may have a monoprocessor or multiprocessor configuration.

Adoption of high-performance 16-bit microprocessors (Z8000, 80286, J11) and of electric and mechanical standards accepted by important industrial groups.

Basic software (center operating system and communications protocol) decidedly superior to that of the majority of the systems currently on the market.

A complete programming environment based on the Olivetti MOS operating system.

Applications software which makes use of the latest control techniques.

This articles discusses application of the MODIAC system for controlling the axes of industrial robots. The use of a multiprocessor architecture for this purpose is justified and necessary because of the complexity of the algorithms implemented and the need to guarantee real-time interaction between the operator and the control system. In particular, a development system is described for control equipment based on the MODIAC center. It provides the following services: interactive design and configuration of digital loops for control of robot joints, adaptive control of multiprocessor architecture, and path control plus path error control.

This development system has been interfaced with the SMART robot made by COMAU. The present article is divided into description of the hardware and software architecture of MODIAC, presentation of the digital control development system, and discussion of an interactive programming environment for industrial applications.

MODIAC: Basic Hardware and Software

The basic hardware structure of the MODIAC system is made up of a local network which links different processing centers together. This choice was determined by the fact that integrated plant control requires, firstly, the presence of controllers distributed throughout the plant and, secondly, close interaction among the different controllers and with the supervisory station.

There are currently applications at the individual controller level of which robot control is a classic example. They set computation requirements such as to render indispensable the use of an architecture of the multiprocessor type having the specific characteristics of flexibility and ease of expansion. In this sense a system such as the MODIAC [1] can be used also because of the optimum performance-to-cost ratio which can be obtained from it. The chief hardware requirements of the structure, to be discussed later, may be summarized as follows: characteristics of a medium-series industrial product, a low cost-to-performance ratio, and "linear scalability," that is, the possibility of modifying the monoprocessor system to a multiprocessor system at a cost proportional to the number of modules utilized, efficient implementation of the basic mechanisms of the operating system nucleus, and a high degree of tolerance to breakdown in the applications which require it.

Generally speaking, the systems oriented toward control of continuous industrial processes are characterized by a high level of information exchange with the external environment through pertinent channels, while significant computing power is required of systems oriented toward control of discrete industrial processes.

With these connections kept in mind, two types of architecture were taken into consideration for the local processing center. These solutions permit creation in different ways of clusters of microprocessors connected by a

common bus. The two fundamental structures will be described concisely with reference to the following symbology.

A circle and an arrow denote a module capable of becoming a master bus or master buses (such as DMA [direct memory access] processors and controllers).

A square with an arrow pointing to it represents a device which behaves like a slave in transfers on a bus. In addition to "dumb" devices (I/O [input-output] memory devices), such modules may be special processors supporting the operations of the main processor.

The interface modules between the various buses are represented by a symbol similar to that used for AND gates. They can be controlled only by a master unit present at the end corresponding to the flat side of the symbol. All the potential slave units, on the other hand, will be connected to the end corresponding to the concave side of the same symbol.

Let us now consider the first proposed solution, shown in schematic form in Figure 1. As is to be seen, each processor has access to the resources placed on the local bus (bus P) and not to those situated on other local buses, which are consequently private ones. Consequently, the resources available to all of them are necessarily to be found on the common bus (bus C).

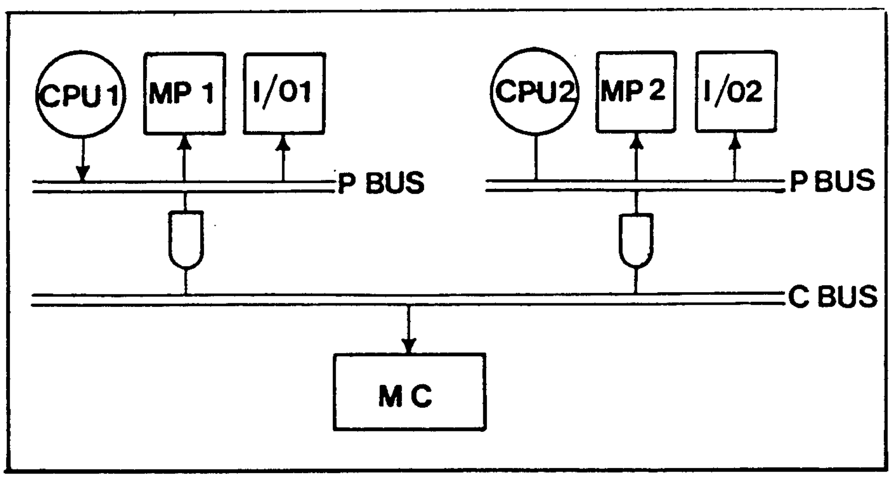


Figure 1. One type of architecture provided in the MODIAC.

An organization of private and common resources representing a step beyond the foregoing solution is effected in the architecture shown in Figure 2. In effect, each processor in this case has access to all the resources connected to its own local bus, which is also a private one. In addition, it can also access, through the common bus, all the resources to be found on a shared bus placed in a different module, which is accessible both from the local processor and from the current master of the common bus. Both architectures have been embodied in the MODIAC modes.

In addition, the hardware has been adapted for to assure efficient development of two mechanisms required by the nucleus of the real-time operating system to be described in what follows. One of them consists of the possibility of effecting integrated reading-change-writing cycles on a global bus permitting the execution of lock-unlock operations. The other mechanism implemented is that of interprocessor interruption accomplished by writing in pertinent common memory locations that generate interruption signals for the various CPU [central processing units] of the system.

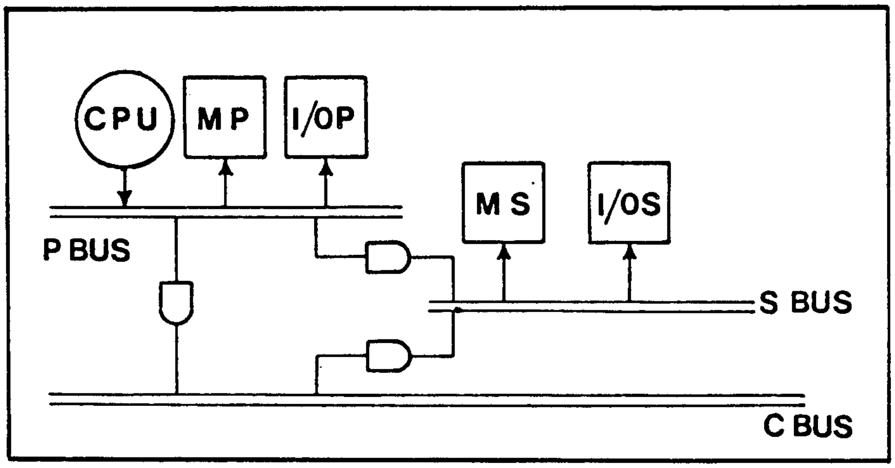


Figure 2. Another type of architecture provided in the MODIAC.

It is also necessary to provide in each center an interface to the network, this being accomplished by means of an appropriate special CPU card which itself is inserted into the multiprocessor system and provides for management of messages to and from the line (10 megabits per second), thereby freeing the other processors from any communication management task and rendering them fully available for the application.

The environment of program execution on the MODIAC is based on the MODOSK (Modular Distributed Operating System Kernel), which is an array of primitives identically replicated in every processor at each center. They can be called as PASCAL procedures.

The primitives are responsible for concurrent execution of the processes executed on the processors in the aggregate and permit interaction among the processes independently of their physical location. The executable code resides in the respective private memories of the various processors; the processes being executed on different processors interact through common objects residing in the shared memory.

Transparency relative to allocation is achieved by subdividing the process descriptors into two parts residing in two different memory spaces. The first part (private descriptor) resides in the private memory of the processor to which the process has been assigned. It contains the local context of the process, its priority, and all information necessary for concurrent execution of the processes assigned to the same processor.

The array of primitives and their relationship to the hierarchically lower functions have been defined in accordance with the recommendations of Technical Committee No. 8 of the Real Time Operating System of the Purdue Europe Workshop [2].

The efficiency links and the shared memory architecture have determined the choice of synchronization mechanisms based on access to global data structures rather than message exchange.

Elementary timing primitives have been created operations P and V of which are semaphores [3].

To minimize conflicts in access to the common bus, the programmer can distinguish between local semaphores (accessible to the processes residing in the same processor) and global semaphores (accessible to any process independently of its location).

The codes associated with the local semaphores contain the private descriptors of the processes in waiting, while the codes associated with the global semaphores contain the parts shared by the process descriptors.

A similar distinction can be made for the SEND and RECEIVE message exchange primitives. Both make reference to a message and a message code without mentioning the process explicitly. The sending process inserts the message into the code if no process is waiting to be received; otherwise it arouses the process which has been waiting for a longer time.

The sending process is never blocked. This choice is due to the fact that a flexible and low-level process is often better than one of a higher level which might preclude some types of solution. Of course, the sending process can be explicitly blocked at a response semaphore at which a signal is expected from the receiver.

Lastly, there are two primitives, ENTERCR and EXITCR, available for definition of critical regions.

A process may assume one of the following states in MODOSK: UNDEFINED, in which the process is unknown to the nucleus; INACTIVE, in which the process is not subject to execution; ACTIVE, which is an abstraction of the states RUNNING, READY, and BLOCKED; and SCHEDULED, where the process is of the periodic type and is automatically switched to the READY state when the time for it arrives.

Transaction among the various states can be caused by any process invoking one of the management primitives of the processor.

A diagram of state of the processes and the names of the chief primitives effected are given in Figure 3.

In addition to the execution environment illustrated in the foregoing, one or more centers of the MODIAC network can be outfitted with a complete set of tools for program development, so as to perform both the functions of a traditional plant supervision station and that of a S/W [software] factory in which to develop, document, and maintain applications programs.

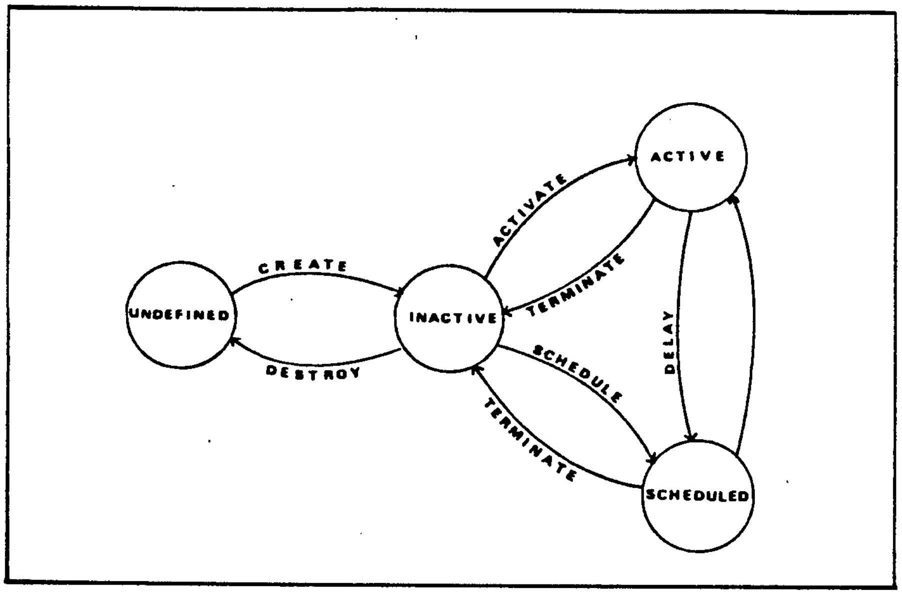


Figure 3. Process state diagrams.

To reach these objectives in an optimum manner, it is necessary for the programming environment to reside in the MODIAC H/W [hardware] and for it to be integrated with the target environment, so as to guarantee full transportability of applications programs from one environment to another.

In accordance with the trends that have emerged in the field of operating systems for 16-bit microprocessors and with a view toward integration of resources and capabilities at the national level, the Finalized Project sponsored a cooperation agreement between CNR and Olivetti under which the Olivetti MOS operating system is to be transferred to the MODIAC H/W and integrated with the MODOSK virtual machine.

The MODIAC programming environment will thus have available to it the MCL command language, through which the user will be able to avail himself of the MOS functions, comprising chiefly the file system, the editor, the PASCAL+ compiler, the linker/loader, and the symbolic debugger.

It is expected in particular that the MODOSK primitives will be implemented by means of the mechanisms supplied by the MOS, so as to minimize the operating cost. This will guarantee the applications programs executed in the MOS environment the same visibility that the MODOSK primitives will have during their execution in the target environment.

The set of programming tools is completed, lastly, by the PPL (Parallel Pascal Language) precompiler [4], which permits configuration of the physical and logical environment in which applications programs are to be executed, by monitoring the coherence of the resources declared by the methods of their use.

Experimentation with MODIAC in the Field of Automation and Robotics

The research group set up at the Department of Automation and Information Science of Turin Polytechnic Institute has undertaken a series of experiments in various directions in application of the system in the field of automation and robotics.

The interactive front-end with the operator used for purposes of development and analysis of control algorithms was the HP9836 desktop computer equipped with an interface to the global bus of the MODIAC allowing this intelligent console to function as one of the processors of the system [7].

An interface was then developed and perfected for connection to the SMART robot made by COMAU. This permitted initiation of interesting experiments in the field of control techniques and methodologies. And adaptive axis control algorithm has been implemented in particular, and a newly designed method for trajectory generation and control is in an advanced stage of development. The communication interface between MODIAC and SMART allows a MODIAC CPU to communicate with the robot axis control module through an 8-bit parallel port. The axis control firmware has been modified so that the module transmits the reference and current position in each 12-millisecond cycle for each axis controlled by MODIAC, after which it is set to wait for the command coming from MODIAC and sends it to the actuators. The module continues to carry out its own control procedure normally for the axes not controlled by MODIAC. The firmware is capable of distinguishing which of the 6 axes are under MODIAC control, inasmuch as there are just as many lines in the parallel interface dedicated to this purpose. These lines can be controlled by the MODIAC software and are accessible to the axis control module.

Control Algorithm Simulation and Implementation

The configuration described above, made up of the MODIAC system, the SMART robot, and the HP 9836, has permitted direct testing of various static and adaptive control algorithms.

The control algorithm analysis and development software present both in the MODIAC and in the HP 9836 in two compatible versions at the structure level has facilitated and made extremely rapid reconfiguration of the control circuits and analysis of the performance of the various algorithms. In fact, it is not necessary to recompile the programs to modify the configuration of the system, unless new types of functional blocks are defined.

This result has been achieved by making as standard as possible the procedures which implement the individual functional blocks and by creating a simple interpreter which scans a list of records containing a description of the system at the block diagram level. With a structure of this type it is possible to create any desired digital signal processing circuit, inasmuch as a generic functional block may have any number of signals at its input or output, which are stored in code of suitable length so as to be able to access previous samples as well.

The functions thus far implemented are divided into two categories, simulation and supervision functions. The main ones in the first group are

pole and zero filters (which may be used as an adaptive filter), determination of the parameters of an adaptive filter through recursive orthogonal factoring, and communication between HP 9836 and MODIAC at the signal and parameter level.

The term "simulation" is not to be construed in the strict sense, inasmuch as these same procedures may also represent the definitive control system. The functions of the second group, on the other hand, have the aim of facilitating analysis of the performance of the system in the development stage. They comprise in particular graphic real-time display of the progress of a signal, plotting of a signal segment, and digital display and/or print-out of the progress of a signal.

These functions have been implemented only on the HP 9836, which acts as interactive console for the entire system. Procedures are also available on the same console which permit calculation of the coefficients of a digital filter once the poles and zeros have been given, as well as display of the transfer function.

All these functions can be executed in real time when the preselected time scale is compatible with the speed of the peripheral used. It is interesting to note how these functions, which correspond to blocks with a single input, can be compared to measuring instruments (oscilloscopes, recorders, etc) equipped with an input "probe" that can easily be moved from one point to another of the "circuit" which is being simulated.

By way of example we can describe the operation of the procedure which implements a generic pole and zero filter with an input and an output. When the interpreter encounters a filter description record of this type, it calls the procedure, passing the record itself as a parameter. The procedure reads the number of poles and zeros from the record, a pointer to a data area containing the coefficients (variable in the adaptive filter) and the pointers to the input and output signal codes. On the basis of this information the procedure calculates the new sample at the output and updates the corresponding code.

The interpreter recalls all the procedures corresponding to the various functional blocks. To add another type of block, it suffices to code the corresponding procedure and to insert into the list the description records which it recalls. In the initialization stage it is also necessary to allocate the data areas for the procedures and signal codes.

A significant advantage is represented by the fact that, while there are differences between the programs which implement this module on the console and in the MODIAC system, the data structures are perfectly compatible and utilizable by both systems, even simultaneously, this rendering mixed configurations possible and easy to develop.

The control algorithms tested comprise various static filter circuits and an adaptive filter developed by the MUSMAR (Multi-step Multi-variable Adaptive Regulator) method [5].

Adaptation of the parameters is calculated by means of recursive triangular orthogonal factoring [6].

In its MODIAC implementation, the adaptive algorithm has been divided between two processors (in the single-axis version). One of them calculates parameter adaptation, generating the factoring of the system matrix by the Givens method, while the other performs digital filtering with the parameters supplied by the other one. For the time being preference has been given to this solution over a more complex one studied earlier [2], in order to reduce the overhead occasioned by synchronizing a large number of processes with each other. To control all six axes of the machine, it is necessary to dedicate one processor for each axis to parameter adaptation, while two processors should be enough for filtering for all axes. In the optimized definitive implementation, the system is to be able to adapt the parameters of each axis every 8 to 10 samplings.

A trajectory generation and control module is in an advanced stage of development. It makes it possible to cope with the problem of controlling robot movements from a totally different perspective, the dynamics of the system as a whole being considered rather than each individual axis separately.

The module generates and controls trajectories in an orthogonal cartesian reference system. The generation algorithm calculates the positional references for each axis of the machine at each sampling moment, after the points of departure and arrival have been assigned. Movement may take place at maximum preset speed and acceleration or with the maximum speeds and maximum accelerations of each axis considered to be links, so that at least one axis is always forced to work at the limit of its capabilities. "On the fly" connection between two adjacent sections is also possible, without stopping movement.

In the trajectory control circuit, the references created by the generation algorithm form part of a dynamic model which controls the robot axes individually; they may also be simulated. The innovative feature of the circuit consists of an external reaction cycle which compensates for the absolute positional error of the machine (in cartesian coordinates). One function of the error vector, which considers the normal component differently from that tangential to the preset trajectory, amounts to reaction on the references generated.

Interactive Programming Environments

The development of advanced and comfortable programming environments is of fundamental importance for rapid spread of complex high-technology systems such as robots and automatic processing cells. For this reason, an increasing commitment is being made in the field of software engineering to to the design of interactive and parametric programming environments noted for their user friendliness, uniformity, and flexibility.

The user friendliness of such programming systems derives from a combination of two aspects, transparency and interactivity. Transparency means that the user is aware only of the software tools which he needs to develop his programs, typically an editor and interpreter-debugger, while the other modules of the system, such as compiler and linker, are called up automatically by the system when required.

The interactivity aspect is a twofold one as regards two different factors, translation and program execution. Compile-time interactivity implies that programming errors can be diagnosed as soon as they are made and accordingly can be corrected immediately.

This objective can easily be reached thanks to the recently developed syntax editor technology. These editors can guarantee that a program is correct through all stages of its development.

Run-time interactivity applies to the possibility of suspending a program during its execution, modifying part of it by means of the editor, carrying out debugging operations, and then resuming execution from the point of suspension. This possibility, which depends on the presence of an efficient symbolic debugger, is necessary in such applications, inasmuch as it is inconvenient to restart the program from the beginning in the event of trouble, because of the great number of interactions that have already taken place between the controlled device and the external environment (consider the example of a robot in a processing cell).

The chief characteristic of these advanced programming environments is uniformity of the component software modules. This uniformity is achieved by making use of an internal representation of applications programs which is unique and common to all the system modules (editor, compiler, linker, interpreter, debugger). The programming system is accordingly an open one, in that new software tools can easily be added provided that they make reference to the common handling routines of the internal program format.

Another characteristic of such programming systems, indicated above, is flexibility. This implies that the component software modules are generic to a high degree and may thus be customized on the basis of a formal description of the user language. This requirement follows from the consideration that an industrial product may exist in different versions each of which has different programming characteristics. In addition, the product may evolve and consequently require adaptation of the user language and the programming environment to the new situation. Consequently, there must be an ability to generate complete programming environments systematically so as not to incur high software costs as soon as the industrial products supported have been changed. As has already been noted, a very comfortable user-system interface can be created by using the recently developed syntax editor technology. Such editors differ from the conventional text editors in that they depend on the particular language in which they operate. Their main characteristic is that they guarantee a program to be correct throughout its development.

Many existing syntax editors are also structural ones, in that they require program construction and modification to take place exclusively through manipulation of syntactic constructs of the applications language and do not permit editing of individual characters. The chief advantage of a syntax editor is the speed of program development, in that the conventional programming cycle, which consists of alternate editing and compiling stages and is repeated until the program is free of compiling errors, can be replaced by a single session with the syntax editor. In addition, because of the support which it can provide, the time which the novice programmer takes to learn the rules of the languages can be greatly reduced. Examples of syntax

editors in integrated programming environments are to be found in the Gandalf Project [8] and in the Cornell Program Synthesizer [9].

Within the context outlined in the foregoing, one of the authors has developed a syntax editor generator which, on the basis of a formal description of the target language, creates a series of tables suitable for guiding a generic syntax editor.

This editor is capable of manipulating a standard internal format and provides a set of commands in common use. Together with the tables created by the generator and the separately written specific semantic routines, it becomes a syntax editor customized for the target language. A description of this system and an example relating to a language for robotics are to be found in [10].

Such a software system can be oriented in particular toward support of various devices (robots, PLC, numerically controlled machines) present in an automated production cell; it accordingly represents a general-purpose development tool for applications programs written in different languages.

This study was financed by the National Research Council under the Finalized Information Science Project, MODIAC Objective.

BIBLIOGRAPHY

1. S. Rivoira, A. Serra, "A Multimicro Architecture and its Distributed Operating System for Real Time Control," PROC. IEEE INT. CONF. ON DISTRIBUTED COMPUTING SYSTEMS, Miami, Oct 1982, pp 238-246.

2. TECHNICAL COMMITTEE ON REAL TIME OPERATING SYSTEMS, UP-TO-DATE REPORT, European Workshop on Industrial Computer Systems, April 1982.

3. E. W. Dijkstra, "Cooperating Sequential Processes," in F. Genuys (ed.), PROGRAMMING LANGUAGES, Academic Press, New York, 1968.

4. G. Clemente, S. Congiu, A. Fornea, M. Moro, "PPL Language and Programming of the MODIAC Multimicro System," COLLANA RAPPORTI MODIAC,, No 18.

5. C. Greco, G. Menga, E. Mosca, G. Zappa, "Performance Improvements of Self-Tuning Controllers by Multistep Horizon: the MUSMAR Approach," AUTOMATICA, Vol 20, No 5, September 1984.

6. G. Bruno, M. Contenti, S. Rivoira, "Distributed Implementation of an Adaptive Controller, "COMPUTERS AND ARTIFICIAL INTELLIGENCE," Vol 2, No 6, December 1983, pp 541-556.

7. M. Contenti, M. Gallo, M. Parvis, E. Prinoli, "Intelligent Consoles for Development of Control Algorithms in a Multiprocessor Environment," PROCEEDINGS OF THE ANIPLA NATIONAL CONFERENCE ON DIGITAL TECHNOLOGIES AND TECHNIqUES IN PROCESS CONTROL, Turin, November 1982, pp 491-502.

8. R. Medina-Mora, P. H. Feiler, "An Incremental Programming Environment," IEEE TRANS. SOFTWARE ENG., Vol SE-7, Sep 1981, pp 472-482.

9. T. Teitelbaum, T. Reps, "The Cornell Program Syntehsizer: A Syntax-Directed Programming Environment," COMM. ACM, Vol 24, Sep 1981, pp 563-573.

10. G. Bruno, "A Syntax-Directed Editor Generator for Robot Programming," PROC. IEEE COMPSAC '84, Chicago, November 1984.

6115
CSO: 3698/64

FACTORY AUTOMATION

ALFA ROMEO R&D PROGRAM LEADS TO NEW 'FLEXIBLE LASER' SYSTEM

Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German
13 Nov 85 p 5

[Article: "Lightweight Solution for Chassis Construction--Alfa Romeo Examines the Use of Laser Welding Technology"]

[Text] Alfa Romeo is engaged in an extensive experimental program using the most modern laser welding technology. Among others, new lightweight solutions for automobile construction are to be examined. Some relevant details have now become known. The project involves the production of superlightweight sheet metal components using thin sheets (0.6 mm) by using the most modern laser welding technology in chassis construction. New ways have been successfully discovered on how to utilize the performance capability and flexibility of modern laser welding technology in the building of automobiles.

The results of the research project, which involved the CISE (Centro informationi studi esperienze) and the research department of Alfa Romeo in a joint effort, is a new type of patented "flexible laser system." In this case, flexible means that it can be adapted to various work processes and performs laser functions in a variable way. The system consists first of two carbon dioxide laser units, each of which has a capacity of 2.5 kw. Both laser units are of the anhydrous carbon type and are able to radiate a laser bundle of a 2.5-kw constant output on a wavelength of 10.6 micrometers (infrared). Use of these smaller units avoids use of maximum-capacity laser sources. This is important because the industrial fabrication area still harbors certain reservations with respect to the use of maximum capacity laser sources in industry.

Work processes which can be accomplished with the laser include cutting, welding, annealing (heat treatment) as well as fitting of mechanical components or chassis parts. This flexible system, which is based on the bundling or gathering of laser beams is composed of a group of laser light sources, an optical decoupling unit, a synchronizer for laser light bundles, an adjustment unit to permit the exact adjustment of the laser beams, depending on the work process involved, as well as a group programming device for work processes.

With the aid of the system, a desired laser function can be applied at any time within a specific work process in a deliberate manner. The laser function can be based on a single laser light source or, where necessary, on the

sum total of several light sources. If, say, three laser light sources of 2.5 kw each are combined, a maximum laser capacity of 7.5 kw is available for a specific portion of the work. In the opinion of Alfa Romeo technicians, this presents many new multisided opportunities in the manufacture of automobiles.

As an example, a complicated lightweight structural shape was produced for the automobile frame manufacturing phase. With the assistance of laser welding, it was possible to fabricate a new type of sheet metal structure to be used as a frame component, which in comparison to existing components, is characterized by greater strength and lower weight. Thus, by welding three layered pieces of sheet metal measuring 0.6 mm in thickness each, a torsion-resistant fitting form was fabricated. The middle piece of sheet metal, which is folded into a tri-square shape, acts as the stiffener. The distortion-free welding process, using the new laser system, takes place in the experimental facility at a working pace of 4 to 5 meters per minute.

5911
CSO: 3698/172

MICROELECTRONICS

SUBSIDIES, RESEARCH AT NETHERLANDS' MICROELECTRONICS CENTERS

Rijswijk PT AKTUEEL in Dutch 25 Sep 85 p 5

[Article by Ing. Richard Hovers: "Microelectronics Centers Well Established after 3 Years"]

[Excerpts] The three CME's [Microelectronics Centers] will cover the microelectronics field at the "Het Instrument" Fair. Ir. H.J. Bosch, manager of the Centers and of the SCME [CME Foundation], the umbrella organization, gives us his impression after 3 years of how matters stand with microelectronics in the Netherlands, particularly in small and medium-sized companies. For a while the Centers will still need some 10 million guilders a year from the government to stimulate microelectronics applications.

As of now Ir. H.J. Bosch has been involved with the CME Foundation for some 3 years, first as coordinator of the CME in Twente when it was being set up, later as manager of the SCME, the umbrella organization for the three Microelectronics Centers. The SCME coordinates the Centers' activities and is responsible to the government, "for the Centers," according to Bosch. In 1984 revenue amounted to roughly 10 million guilders, of which 7 million came from the government and 3 from the Centers' own work. After their first 3 years of activity--the management was appointed in September 1982--the time has come to evaluate the CME's and to consider their future. It is clear in any case that their advisory work and their work in developing new techniques and products will continue to require subsidies from the government. At the same time, the Centers will generate some of their income themselves by privatizing the projects they carry out.

Bosch: "At the end of October the data from a study will be available to the Centers, and the government and we will be able to take a look at what we need to do. Of course we already have a very good idea about developments in the field of microelectronics in small and medium-sized companies. In addition, in the spring of 1984 we hired a firm in Amsterdam to survey how well known the Centers are among small and medium-sized companies. All in all it turns out that there is still an awful lot of work to do in small and medium-sized companies, their general awareness of microelectronics is still far too low. A study shows that no less than 2/3 (66 percent) of small and medium-sized companies think microelectronics has nothing to do with them. So this field calls for an awful lot of stimulation, and given the fact that government policy considers it important to stimulate high technology, we hope that the government will pump 10 million a year into the CME's in the future."

Three Tasks

As time has passed the CME's have found themselves performing three tasks. The first is advisory work. Tom, Dick, or Harry can call up to ask where they can get something. The increasing number of questions shows that business is making more and more use of the Centers. In 1983 the number was 700--with a

minimum of 30 minutes spent on each query--but in 1984 it rose to over 1800. The main sources of questions are the agricultural sector, electronic engineering, and the metal industry. Undoubtedly the improved economic situation is also partly responsible for the increase.

A second task of the Centers is research into new techniques and products, finding industrial applications for the new possibilities offered by science. This has gone fairly well in the past; the problem however is that you usually have to spend money to make money. That is why the CME wants to focus more on industry and be more commercial in this field. That is why they have created the so-called applicability studies, of which some 15 are currently under way. How do these work? Bosch: "Either we or third parties (we regularly contract out the work) take a look around at a company with microelectronics in mind and point out needs in production or in the products themselves. It may be that some microelectronics will make it possible to improve or speed up a process. In appropriate cases we can then provide a 50 percent subsidy (up to a maximum of 30,000 guilders) for projects of this type." Bosch: "It goes very easily. Within a week we decide whether the subsidy can be granted. The bill is handed over and settled at the end of the project, thus no run around and no red tape, a fast system. With the money we have from the government, we have made a little room for that in our budget; this year it amounted to around a quarter of a million, and next year it will be more. Time and time again we have found it difficult to get businesses to contribute themselves to the costs of the study. The policy on this is being reconsidered. Still, there have been positive experiences, such as with MHB BV (Herveld Betuwe Metal Windows, Inc.), which was able to formulate its policy clearly through an automation plan we produced."

The Centers' third task is carrying out projects for industry, i.e. paid commercial assignments, a task that is being considered for privatization. Of course this brings the CME's into competition with engineering firms and so on.

Innovation

At present the three CME's together employ around 100 people: 40 permanent employees and 60 temporary. For the advisory work they have people with a great deal of experience in business, while for the research they usually hire recent graduates from technical universities and higher technical schools. Bosch: "In the past the technical universities paid little attention to industry. That is getting better now. To name some examples, just look at the transfer points and at the contacts that we Centers have with them. Fortunately the universities are coming out of their ivory towers, partly in order to encourage that third source of money. Of course it is great for people to do basic research, but you can't forget about possible industrial applications in the process. Knowledge transfer and innovation are necessary for every company."

12593
CSO: 3698/148

MICROELECTRONICS

ANALYSIS OF FRENCH SEMICONDUCTOR INDUSTRY

Paris L'EXPANSION in French 24 May-6 June 85 pp 111-117

[Article by Gilbert Pointout: "CHIPS: France Is on the Move"; first paragraph is L'EXPANSION introduction]

[Text] Nationalized component manufacturers must, like everyone else, find allies abroad.

Before the 1981 elections, aware of the trailing position of France in the key industry of electronic chips, the Barre government launched a Components Plan. Soon two new companies joined the major national producer, Thomson. They were shepherded by Matra--allied with the U.S. company Harris--and by Saint-Gobain.

The wave of nationalizations swept over them; Saint-Gobain turned over the fruits of its youthful data processing ambitions to Thomson; the technological battle between the Japanese and the Americans raged on.... Where do the two French semiconductor champions stand now?

Their 1984 balance sheets look quite good. In a single year, Thomson-Composants sales were up 56 percent in Europe and 67 percent worldwide; Matra-Harris Semiconductors (MHS) almost doubled its turnover, and this year, for the first time, had a balanced budget. So, the plan really worked?

Not so fast! These numbers need to be put in perspective: first, because, with semiconductor turnovers for 1984 of Fr 2.7 billion (Thomson) and Fr 344 million (MHS), the French companies are far from being at the head of the pack along with the Americans and the Japanese (see Table p 113 [not included]); but also, primarily, because their growth only reflects and follows the expansion of the world market. This market is experiencing record growth--over 40 percent--beginning in mid-1983 and culminating in mid-1984. Last summer, the profession's key indicator (the order/billing ratio) reached a high of 1.5 to 1.7 depending on the country.

But, in this frenetic business, boom is always followed by bust. Orders go down, production is cut: the 1985 outlook is pessimistic again. Manufacturers know there is only one way to handle this: Wait out the storm.

There is a very strong cyclic progression in the semiconductor industry, linked to orders from other equipment manufactures (electronics for the general public, telecommunications, computers, etc.). The personal computer boom in 1983 and 1984 in Japan and America caused a massive demand for components. The market's reaction was logical and typical: Delivery dates were extended and prices were raised (from 20 to 75 percent, depending on the product).

In this atmosphere of shortage, users engaged in panic buying; and manufacturers, well aware that the average long-term growth in demand is form 15 to 25 percent per year, invested to the hilt (between 1983 and 1984, worldwide production capacity grew nearly 80 percent). It is easy to guess what followed: On the one hand, increasing supply; on the other, shrinking demand because of the size of inventories and because certain sectors, like personal computers, ran out of steam. The tables were turned. The order/billing ratio is now only 0.5 in the United States and 0.7 in France. Motorola is now running at less than 80 percent of production capacity; Intel and Texas Instruments are starting to lay off workers; National Semiconductor has already placed some on technical leave. Indisputably, 1985 will be a difficult year, though some people are trying to be optimistic. "At the beginning of 1985, we were at the bottom of inventories and the second half of the year should be even better than the first," predicts Jean Philippe Dauvin, a Thomson economist. Motorola-France simply claims to be "entering a stage of negotiations with clients," which implies a slight recovery in autumn.

Against this backdrop, what are the chances for French manufacturers to achieve their ambitious goals? MHS expects to be the European leader in CMOS technology in 1985; Thomson is hoping for a 60 percent increase in turnover in 1985 and has ambitions of controlling some 3 percent of the world market in 1990 (as opposed to 1 percent in 1984). This may be possible, but the game has not been won yet.

It is true that French companies have come a long way. In 1981, Thomson and Philips-RTC accounted for only 50 percent of the French market. The weakest point was the cover ratio, still adverse (42 percent), especially in the leading technology, MOS circuits. The Second Components Plan, adopted in 1983, is continuing the same strategy: promotion of MOS technology in addition to customized components where France is in a good position (components destined for the military and telecommunications). Economic goals have been adjusted: In 1986, French manufacturers should achieve a 100-percent cover ratio with a production volume of Fr 4.65 billion--the first plan estimated the French market at Fr 3 billion in 1985. The budget of the second plan is Fr 3.2 billion, with 700 to 800 million distributed each year. Four companies benefited from this manna in 1983 and 1984: Thomson (55 percent of the assistance), MHS (35 percent), Philips-RTC, and SGS-Ates (an Italian company in Rennes).

With this plan ending in 1986, it is still too early to judge. However, its goals will probably not be reached either. The 1984 cover ratio was hardly more than 50 percent, and the 2 French companies, Thomson and MHS, still only accounted for a little over 50 percent of the turnover achieved in France. The government made adjustments at the end of 1984: "In 1986, French

production will be 7 percent less than estimated, while the market will be 11 percent greater than anticipated. The cover ratio probably will not exceed 83 percent," according to the March announcement of Jean Louis Teszner, then assistant manager of Dieli (Directorate of the Electronic and Computer Industries).

A (probable) Third Components Plan, to appear in 1986, will have to take these shortfalls into account, as well as the widening gap between France and other countries. Motorola estimates the European market will only account for 16 percent of the world market in 1990 (as opposed to 17 percent in 1984 and 28 percent in 1978); and, even within this European market, France is losing ground: In 1978, French firms used as many components as British firms and about 30 percent fewer than the Germans; Dieli studies show that in 1988 the French should use about 50 percent fewer than the British and the Germans.

Even though the development of French companies is linked to a strong domestic market, growth can only be accomplished through a strategy of international alliances. Many manufacturers, and not just the smaller ones, realize this, as is reflected by the large number of agreements--covering research and technology as well as production and assembly--between Philips and Texas Instruments, Toshiba and Zilog, Hitachi and Motorola, SGS, Zilog, and IBM, etc. French companies are obviously no exception. At the end of 1984, Thomson Semiconductors announced a series of agreements with AMD (Advanced Micro Device), National Semiconductor, Motorola, Telefunken, OKI; not to overlook the contract for delivery of memory circuits signed with IBM, the world's largest manufacturer and consumer of components.

As for MHS, it has created a GIE [Economic Interest Group] with Intel, primarily to co-design customized semiconductors. Also, after months of negotiations, a draft agreement was signed with SGS-Ates. Under this contract, SGS-Ates would assemble, at Rennes, microprocessors manufactured by MHS in its Nantes plant. These agreements confirm the strategy MHS has been applying since the beginning: concentration on a given technology (CMOS) and betting on microprocessors and decentralized networks rather than memories. This seems to have been the right choice because the world CMOS market is developing twice as fast as the rest. According to MHS, it should grow at an annual rate of over 45 percent through 1988. MHS firmly expects to be the European CMOS leader by 1988, taking in Fr 800 million for microprocessors (50 percent of their estimated turnover, as opposed to 27 percent in 1984).

To reach this goal, MHS will invest another Fr 1.1 billion between 1985 and 1988. Production of integrated circuits [IC] should reach 12.5 million this year, partly because of a second manufacturing unit to be in operation in mid-1985. A third unit, with a production capacity equal to the first two combined, will open in 1987.

The problem of financing remains to be solved. So far this has been covered by external investments. Judging from the market, a positive result for MHS is far from guaranteed for 1985. Therefore, the shareholders and the state will have to continue supplying money. Thomson Semiconductors is in an

equally difficult position. It offers a nearly complete product line, as do Motorola and Nippon Electric [NEC], whereas MHS targets a single market niche.

"So far," a Thomson spokesman says, "the different Plans have enabled us to reach a competitive technological level. It was only at the end of 1983 that the ship, finally armed, was able to leave the port." And here again, the government gave it a significant push with Fr 1 billion in capital contributions in 1984, Fr 1.3 billion in 1985 with more than half of this sum earmarked for components. Of the Fr 430 million reserved for IC's in the Components Plan, Thomson received more than half.

Although the ship has left the port, it is still drifting in French territorial waters (Thomson controls about 14 percent of the French market), flirting with European limits (3.5 percent of the European market), but hesitating to set out on the open sea (1 percent of the world market). However, the course is set: "We have to reinforce our position for products with a high growth rate," stressed Jacques Noels, manager of the Thomson IC division. CMOS technology is particularly important among these products because it should account for 40 percent of IC sales by 1988. Retooling has been accomplished: The Eurotechnique plant in Aix-en-Provence, inherited from Saint-Gobain, has doubled its production rate; in 1 year, Efics (Grenoble) went from 300,000 to 1.5 million MOS circuits; and between 1983 and 1984, the overall capacity of MOS manufacturing plants has been multiplied by 2.5. The crew is ready, at last: Over 100 sales engineers have been recruited from around the world.

But, will the ship reach its destination? One expert says, "Thomson is currently betting on the 64K memory, which, along with the 32K memory, occupies the largest share of the market. Japan is working on the 256K. Thomson will not produce its own 256K memories before the beginning of 1986, just a few months before Japan launches its 1024K chip." Thomson is not contesting the Japanese lead in technology, nor will it modify its goal because, for one thing, a hypersophisticated (and expensive) chip will not immediately eliminate the market for less powerful products.

This mad race is exhausting: To increase one's market share or simply to keep it, one has to make huge investments very quickly. One semiconductor plant represents an expenditure of $60 to $120 million. But modernizing production tools is not enough, the research effort has to be sustained. NEC invested $285 million in 1983, Toshiba $255 million, Texas Instruments $225 million, Motorola $215 million, or three to five times as much as Thomson. Of course, as Jean Philippe Dauvin explains, "the total amount of investments is less significant than the outlay it represents compared to total turnover." Nevertheless, it is difficult to imagine that the French effort could modify the structure of the world market and seriously shift the balance of forces in our favor.

25006
CSO: 3698/1034-A

MICROELECTRONICS

BOSCH OF FRG FINDS NEW WAY TO DESIGN CHIPS QUICKLY

Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German 13 Nov 85 p 5

[Article: "With Cell Library Toward Rapid Chip Design--Bosch Invests 80 Man-Years in a Developmental System for Tailor-Made Electronics Applications"]

[Text] In recent years, the Bosch Enterprise has developed into one of the most significant electronics manufacturers in the FRG. Starting with the first series manufacture of electronic fuel injection devices for automobiles in 1967, Bosch has created a mass of microelectronic instruments. Fortified by its own successes in this difficult area, the enterprise sees today that only the mastery of microelectronics will help to uncover new applications and will be helpful with respect to rationalization in the instrument technology field. Interestingly, Bosch is not relying on the rich assortment of offerings in the international electronics market, but rather is developing and producing around one-third of its 1985 purchase volume of electronic components, estimated to be worth some DM 720 million.

The enterprise is manufacturing monolithic integrated microelectronic modular components up to the pretested microchip; Bosch is assembling microchips in instrument housings or in layered circuits and is developing and manufacturing complete electronic instruments by using modular elements of its own manufacturer and of foreign origin. This was recently referred to by Dr Eng Hermann Scholl, the executive officer of Robert Bosch, Ltd., in Reutlingen, where the company has concentrated its electronics efforts.

However, the microelectronics used by Bosch differ in some essential points from customary computer electronics. For one thing, electronic modules are installed in instruments and are scrapped with those instruments once their usefulness has expired; and, for another thing, these instruments which are fabricated for a specific task generally do not need to be augmented with new functions. This then obviates the necessity of having to work with flexibly loadable computer programs. Moreover, the necessary programs are packaged immediately in "solid-state" equipment, right along with the microchips.

Naturally, Bosch did not, like other electronics users, tread the path of the "gate array" technology in which substantially tailor-made electronic chips are adapted to user desires in the final layer, but has set itself the

ambitious task of developing its own special circuits from scratch. The enterprise believes that it can thus produce microelectronic instruments "in perfect form" which will assist the enterprises of the group in achieving important competitive advantages. Toward this end, Bosch created a computer-supported developmental process and invested around 80 man-years of engineer performance into it. It is said that it makes it possible to shorten developmental time for new circuits and to reduce developmental costs; this developmental process can reduce development time to one-fifth of the customary time requirement. Bosch claims that it is even possible for small production runs to be economical. Currently, more than 130 integrated circuits of the bipolar and MOS type are being developed or are in the planning stage.

Naturally, it would not be smart for every new circuit to, so to speak, reinvent the transistor. Even Bosch considered how the design of new circuits can be rationalized. The solution was: proven circuits for the various applications can repeatedly be planned for use where they are precisely correct. Circuit diagrams are stored in electronic libraries. They can be called up at any time by the designer and installed into new circuitry without requiring that the entire detailed design work be redone. For CMOS technology, Bosch states that it has five libraries. Other catalogues are being prepared.

The designer can then work up a raw proposal on his screen and plan the inclusion of cells which are subsequently filled with the desired types of functions which are contained in the library. Bosch has a number of standard cells but also larger macrocells and even entire function blocs available. The cells contain digital but also analog circuits of typical electronic modules like, for example, inverters, Nand- and Nor-gates, flip-flops, latches, and various combination gates. Cells are also available in the form of entry ports, comparators, output drives, three-state drives, and cadence generators. Larger macrocells, composed of several cells, can contain entire functional units such as storage components, timers, analog-digital converters, and I/O circuits.

The designer lists the situation in the new circuit diagram and augments the necessary cells by pressing a button. The developmental computer is then in a position to automatically connect the components and electronic groups in the circuit with conductor trails. What is important is that the developmental computer also computes whether the conductors and the cells are sufficiently separated from each other so that flashovers do not occur later in practice and that undesirable capacitance effects are not caused. Thus, serious layout errors can be avoided as early as the developmental stage. This viewpoint is of particular importance in developing circuits which house control and output electronics in one and the same microchip, since output electronics permits the use of electric currents which are absolutely deadly to the sensitive control electronics portion.

Once the future circuit has been worked out in the development stage, it is tested with logic and circuitry programs for conformance with the initial requirement. The special testing programs are also automatically produced by Bosch. The geometric arrangement of the cells and their wiring is undertaken in an error-free manner by the computer, according to Bosch. It is said that

to determine dynamic data, the circuit is produced in back of the geometric proposal and can be compared with the starting circuit. Procedures for the testing of the geometry for adherence to developmental rules and for testing conductor trails for continuity conclude the developmental phase according to the presentation by the enterprise. Functional samples of circuits can be produced on an in-house fabrication line within a very short time; final series production can then be undertaken either by Bosch or by another semiconductor manufacturer. Chip production requires some 102 production steps, including 52 testing steps and 6 quality tests.

5911
CSO: 3698/171

MICROELECTRONICS

PHILIPS DEVELOPS NEW KIND OF SEMICONDUCTOR SENSOR

Duesseldorf VDI NACHRICHTEN in German 5 July 85 p 15

[Text] A semiconductor image sensor with double the light sensitive elements per surface area of existing sensors, was developed by the Philips Research Laboratory. Instead of the previous four, only two electrodes are needed per image element. Without refining the electrode structure, this was possible solely by changing the charge transport. The potential walls between the image information are first pulled apart in series, and then pressed back together like the bellows of an accordion.

In order to collect the charge, two electrodes per cell are sufficient in principle. Charge transport is then no longer easily possible. The accordion principle was thought by Philips, Eindhoven (Netherlands) to be a remedy: The image information is no longer transported all at once to the storage unit, but each charge packet is first delayed--beginning at the lower image edge--and distributed over the area under two electrodes. The charge packets are then separated from each other by a potential wall having twice the electrode width. The charge transport is then possible again in the normal manner.

Thus the image information is peeled off line by line. The short-term "expansion" of the information is again terminated when the charge packets reach the lower edge of the storage unit, so that a series of image elements is again brought under two electrodes in the storage unit. In the final, line-by-line read, at the lower edge of the storage unit the space needed for the next expansion of charge packets becomes free for the transport to the lower edge.

In this manner, a much smaller cell size can be attained, while retaining the production method using 3.5 mu-m technology. Now a total of 604 x 588 light sensitive elements can be placed on a surface of 38.2 mm^2. Together with local reductions in electrode width, this leads to a greater sensitivity, especially in the blue range.

The accordion image sensor consists of a picture unit and a storage unit. The picture unit is shown on the right as a dart surface; the bright surface on the left is the storage unit. The electronics for producing the voltage to the electrodes is located at the edges. The enlarged image section shows the region of transition from the picture unit to the storage unit.

9280/12790
CSO: 3698/107

MICROELECTRONICS

BRIEFS

REGENSBURG CHIP FACTORY OPENS--Five months after laying the foundation, Siemens Co. celebrated the opening of a new semiconductor plant in Regensburg on 21 March. The shells of the two large production sheds (40 m x 108 m each) have been completed; one of them will produce the actual chips. In the other shed, the chips will be assembled and tested. The nucleus of chip production will be a 3800 m^2 clean room. In Regensburg, Siemens intends to produce microelectronic components with sizes down to 1.0 mu-m, including dynamic 1 Mbit RAMs by 1987. The 50 mm^2 1 Mbit chip will combine 2,000,000 component functions. The megabit plant is designed for "Purity Class 10", which allows at most ten particles of max. 0.5 mu-m per cubic foot of air (27 liters). The recently completed semiconductor plant for 256 kbit RAM (dynamic) in Villach, Austria, operates under the same conditions. The hourly two million cubic meters of air filtered and circulated in the Austrian plant equals only half of the air circulation in Regensburg. The new facilities in Regensburg are on a 12,000 m^2 site and up to 1200 workers will be employed at peak times at the Siemens plant on the Danube. [Text] [Duesseldorf VDI NACHRICHTEN in German 19 Jul 85 p 15] 9280/12790

SCIENTIFIC AND INDUSTRIAL POLICY

INTERVIEW WITH OFFICIAL WORKING ON FRG EUREKA POLICY

Duesseldorf VDI NACHRICHTEN in German 27 Sep 85 p 5

[Article by G. H. Altenmueller and W. Mock: "Technology Policy: Eureka Last Chance for Europe? Lutz Stavenhagen on the Europe of Technology, of the EC, and of SDI"]

[Excerpts] He has taken office under a lot of pressure to succeed: concrete decisions that can be produced against our competition in the U.S. and the Far East must be achieved at the next ministerial conference on the subject of Eureka in Hannover at the beginning of November. Lutz Stavenhagen, 45-year-old business and political economist from Pforzheim with an international educational background, is now, as a new under-secretary in the foreign office, the man to whom Europe-policy-makers are looking. He gave his position on issues of "the Europe of Technology" for VDI-NACHRICHTEN.

Even though Foreign Minister Genscher (FDP) still has the responsibility and is still at the policy help, Stavenhagen, as a budget and research-policy expert for the Union in the Budnestag, is not only an outsider in the Foreign Office, but also the expert with the best credentials for the things that count in creating a European Technology Community, namely substansive ideas and financing.

In the Federal Research Ministry which, a little piqued at the foreign minister's activities, has been holding back all too long, Stavenhagen is regarded as a dream foreign-office partner for this project. Finally, when still rapporteur for the research budget in the budget committee, he successfully fought to shake money loose at all for the Eureka project.

"In the framework of Europe policy," Stavenhagen told VDI-NACHRICHTEN, "there are two points of emphasis above all: forwarding European union, and the Europe of Technologies." At the center of the efforts for a united Europe stands one project above all: Eureka. "Eureka goes beyond the boundaries of the 10, or the now soon-to-be 12, members of the European Community." In addition--and this is a great advantage as compared to EC projects--Eureka will proceed on the principle of variable geometry, i.e., each different project with different participants will be led by a different country or firm.

"But" - Stavenhagen lays great emphasis on this--"what we're looking for is not just a few spectacular projects, but we must rather push the Europe of Technologies forward even in little things: in unification of standards and interfaces; these must become compatible, so that procurement markets also get bigger. That must remain the second leg."

Precisely in this last area Stavenhagen sees an important role for the European Community. The EC signs as a partner in the Eureka-programs framework along with the participating countries.

An organization comparable to the Brussels bureaucracy is to be avoided for Eureka at all costs. The direction of the individual projects in Eureka is to be handed over to a non-government organization. Those partners who are collaborating on a project are also to organize its leadership themselves. "No officials, no agency, but rather the greatest possible flexibility."

The shaping of the projects still lies in the hands of the responsible politicians at the present moment, of course in close consultation with industry. In this way industry's interest in these projects can be assured. "Industry's interest," Stavenhagen concedes, "naturally varies, until we know how the financing will go and what time-horizons we're dealing with." Precisely for the financing, however, there are as yet no definite principles. Before the Hannover conference, the participants are to work out the guidelines needed here, and to include them in a statement of principles.

Stavenhagen mentioned some basic criteria, however: -the closer projects are to commercial development, the less public money; -Eureka subsidies are to be no better and no worse than national ones, hence 50 percent on average.

Things are not very far along with the finances, to be sure. The 50 to 60 million marks that are available for research and technology in the Federal Research Minister's budget will be used for preparatory [as published: prepared] studies and similar tasks.

But what will become of the EC technology projects, if Eureka is the success everyone hopes it will be, and if the "variable geometry" type of organization proves itself? A highly paid stateless bureaucracy for subsidizing agriculture? Stavenhagen doesn't see such a danger: "The EC behaves like a partner country and is participating in Eureka within the framework of its budget. Secondly, it is undertaking important tasks, that is, it is creating the legal conditions for the unifications of norms and technical standards. Some of the projects we're doing with Eureka, too, are centainly compatible with the traditional technological tasks of the EC. I don't necessarily see any problems here."

But what preconditions does Bonn have for pushing European research forward? Stavenhagen himself could not dispel the impression that even the Federal Republic's research policy has not been especially Europe-oriented. "In the past we often had the principle of the 'just return' in European research

projects, each wanted to get back as much as he had put in. We have yet to learn that we get ahead only as a community, that it's in the interest of all to work in common, because the costs are so extreme. Then a stronger orientation toward European research will also appear. And if we have success with Eureka - without a cumbersome bureaucracy--then this trend toward European community cooperation will increase.

Of course it just isn't the case that European firms aren't cooperating and doing research in common today. If a worthwhile market exists, it will be served. So what is Eureka supposed to be doing that's new, except perhaps financing European prestige projects? "Certainly," says Stavenhagen, "when commercial development is very close, industry moves on its own. Government isn't needed there. But there are a number of things, like the superfast computer, which are of central importance for tomorrow's competitiveness, but whose development costs are too much for industry today, too much even for two or three corporate partners." Here government should step in, but industry's interest--through its financial participation in such projects--must remain clear.

Just as the Europe of Technologies and the European domestic market are not directed against other trade partners, so Eureka is no competition for SDI. "We regard Eureka as compatible with SDI or neutral with respect to SDI. Eureka has something for every European country, independently of its position on SDI. Eureka is a civilian research project, even if we cannot deny potential military spin-offs."

13070/9190
CSO: 3698/118

SCIENTIFIC AND INDUSTRIAL POLICY

MAX PLANCK INSTITUTE AGAINST PARTICIPATING IN SDI, FOR EUREKA

Frankfurt/Main FRANKFURTER ALLGEMEINE ZEITUNG in German 4 Dec 85 p 1

["Max Planck Society Against Secret Research"--AP headline]

[Text] The Max Planck Institute has raised considerable reservations against its participation in the American research involved in the SDI missile defense system under present conditions. The president of the private research society, Heinz Staab, recently stated in Bonn that the necessary prerequisites for the work of the Max Planck Institute is the "free information exchange" with scientists from all over the world. Secret research in these institutions is said to be "unimaginable." Thus far, the Max Planck Institute has not been asked by any side to participate in SDI.

The president welcomed the Eureka concept of the European Technological Community, which in the meantime has been expanded, which permits freedom of basic research and does not represent a European competition model for SDI. Another viewpoint is said to be that this concept augments the "one-way street" of researchers and research results from Europe to the United States by cross-connecting European science. It would naturally have been better had the program been based on existing scientific contacts and not "imposed from above."

Staab reiterated the objections against German participation in a manned space station which had been jointly formulated by the German Research Community and the West German Conference of University Rectors. In view of limited financial means for research, particularly stringent yardsticks have to be applied to possible scientific results. The limits of "science on the grand scale" lie where the breadth and multiplicity of basic research is overpowered.

5911
CSO: 3698/173

SCIENTIFIC AND INDUSTRIAL POLICY

BRIEFS

ESPRIT ACCEPTS CNET PROJECTS--Paris--Eighteen proposals were submitted jointly by CNET [National Center for Telecommunications Studies] laboratories and a number of partners (research and industry) from France and from other EEC member countries in response to the European Economic Community's invitation to bid on the Espirit (European Strategic Program for Research and Development in Information Technology) program. Following a technical evaluation, nine CNET proposals were selected for negotiation by the Commission of the European Communities and the bidders. Five of these proposals involve microelectronics (CAO-VLSI, flat screens, Ga-As lasers, Bipolar integrated circuits and integrated circuit simulation), two involve office automation (electronic documentation, interactive audiovisuals), one is for software engineering (use of information bases) and one for information processing (voice synthesis). Two of these projects are to be classified as strategic projects (over 5 million ECUs). [Text] [Paris AFP SCIENCES in French 3 Oct 85 p 7] 12798/12899

EUREKA OPEN TO NON-EUROPEANS--Eureka, the European Program for Technological Cooperation, is now open to non-European countries, announced Hubert Curien, the French minister of Research and Technology on 28 Sept in Beijing. For example, the Chinese, who have expressed an interest in Eureka, would therefore have the opportunity to participate in the European program. During his trip to China, Mr Curien also raised the issue of a potential joint French-Chinese project for the construction of an earth monitoring satellite. According to French sources, Beijing has also expressed an interest in such a project. [Text] [Paris ELECTRONIQUEACTUALITIES in French 4 Oct 85 p 3]

PHILIPS PARTICIPATION IN ESPRIT--Eindhoven--The Dutch company Philips will participate in 17 new Esprit projects, half of which will be subsidized by the EEC, announced a Philips company spokesman on 2 Oct in Eindhoven. According to the company, the firm will participate in the second phase of the European Strategic Program for Research and Development in Information Technology (Esprit) requiring an investment of 70 million florins (1 Dutch florins = 2.7 Fr). The major project to be undertaken by Philips in partnership with 14 other companies will focus on the development and implementation of advanced programming systems designed for application in manufacturing processes. Some 93 projects have been approved for the second phase of the Esprit program. The European Community has allocated over 1.6 billion florins to this phase. [Text] [Paris AFP SCIENCES in French 3 Oct 85 p 7] 12798/12899

FRG ADVANCED RESEARCH FUNDING--Federal and state governments plan to spend around 1.9 billion marks for basic research next year. This is about 3 percent more than in the previous year. The Federal-State Committee on Educational Policy and the Promotion of Research (BLK) decided on Friday to raise the budget of the German Research Community (DFG) by 28 million to 976 million. The budget of the Max Planck Society is to rise by 26.6 million to 814 million marks. The sum of 114.5 million marks will be applied to the so-called "service installations" of the research institutes. Bremen recorded reservations here. Science Senator Horst-Werner Franke (SPD) said Bremen had to wonder, in light of its own budgetary problems, whether it should lay out so much money for a Society that up to now "has not shown the slightest commitment to our State." [Unattributed article under the column heading "Science and Research"] [Text] [Duesseldorf VDI NACHRICHTEN in German 11 Oct 85 p 9] 13070/12859

CSO: 3698/119

END